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12FEB04 E872537-10 D02825
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2. Patent application number *(The Patent Office will fill in this part)* — 0403020.1

11 FEB 2004

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

PA Consulting Services Limited,
123 Buckingham Palace Road,
London SW1W 9SR,
United Kingdom.

00678881007

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

4. Title of the invention — Portable Charging Device

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

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Number of earlier application	Date of filing *(day / month / year)*

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Portable Charging Device

The present invention relates to a portable charging device, and in particular to such a device used for delivering a fast charge to a range of household electrical devices designed to incorporate a charge transfer interface and power storage device(s). The present invention also relates to a household electrical device, in particular such a device adapted to be powered by such a portable charging device, and more particularly to a portable delivery device for household use.

Many household electrical products require low power to deliver their specific function e.g. household delivery devices. Household delivery devices are used for the release of a range of volatile actives, including their use in delivery of air fresheners and pest control products. Such devices manifest themselves in a variety of forms that can generally be divided into passive and active systems. The latter incorporate an energy source to boost the release of actives and enable the effective use of lower volatile molecules. Other household electrical products require higher power delivery but for short times e.g. portable vacuum cleaners, electric carving knives, electric razors, toothbrushes, torches etc. Such devices are generally mains or battery driven.

Plug in electrical systems meet the needs where a continuous power source is required with relatively high power usage. However such devices have a number of consumer negatives, such as: they occupy a mains outlet socket; they restrict the location opportunities for placing the product; they reduce the opportunity for maximum effectiveness, i.e. hidden behind furniture, away from the bed etc; they may not be suitable for UK bathrooms where safe power sockets (shaver outlets) are not so common; and/or they require electrical leads which trail, get in the way and can become hazardous with wear and tear.

Plug in electrical household delivery devices, which have seen a rapid growth in popularity over the last few years, use mains power to assist delivery through a variety of ways, such as heat, fan assist etc.

Such household delivery devices suffer from the additional problem that being hidden, they are difficult to get to, adjust and can lay empty for some time before this is noticed.

As an alternative and to provide increased portability, a large number of battery operated devices have been developed. These utilise a range of battery technologies and are either disposable or rechargeable.

A number of battery operated household delivery devices have been developed and launched (for example, SC Johnson's "ON & ON" air freshener). The use of batteries however, is often seen as a negative by the consumer since it necessitates another consumable element, which has a negative environmental impact, adds on-going cost and can easily be forgotten about, rendering the device inactive.

Battery systems that utilise rechargeable technologies have historically been rejected since the time to recharge the cells can be significant, air freshening and pest control is normally seen as an instantly reactive activity rather than one that you have several hours to plan for.

However, disposable batteries, although they have good shelf life, have a number of inherent characteristics often seen as negative by the consumer, such as: additional and expensive consumable element; high weight; low power density; and environmentally unfriendly.

Re-chargeable batteries address some of the above issues, although inherent negatives still exist, such as: high weight; low power density (although NiCd cells address the power density issue to some extent); environmentally unfriendly; relatively slow re-charge rate even for "rapid charge" systems; and/or re-charge memory, limiting charge capacity if recharge regime is not followed and leading to reduced life expectancy of products where the rechargeable cells are not user replaceable.

According to a first aspect of the present invention there is provided an electrically powered portable charging device suitable for temporarily storing electrical charge for delivery to an electrical device electrically connectable to the charging device, the charging device comprising at least one storage element for temporarily storing electrical charge, an input for receiving, from a separate charging base unit to which the charging device is electrically connectable, an electrical charge to be stored by at least one storage element, and an output for delivering the stored electrical charge to the electrical device.

Preferred features are defined in the dependent claims.

A preferred embodiment provides a portable charging wand which can electrically mate with one or more portable powered household devices having the electronics and circuitry developed so as to provide for very rapid re-charge rate in a consumer friendly way. Such powered devices are ideally suited to the use of fast charge super capacitors as the internal power source.

Such devices are not limited to those identified above, which are used purely as illustration, but could also take the form of a variety of hand held powered cleaning products, kitchen utensils, personal grooming products etc characterised by either: medium power portable devices used for a relatively short time i.e. for illustration this could be electric razors, torches, whisks, hair clippers etc., or lower powered portable devices that may be continuous, pulsed or used intermittently and for which having to wait an extended period of time for recharging provides significant inconvenience, for illustration this could be a household delivery device etc.

The wand can incorporate: re-chargeable batteries, trickle charged through a docking station plus suitable control circuitry which can in turn provide the super capacitors within the device or devices with high current flow and therefore provide for rapid charging through a simple electrical mating operation; and/or master super capacitors with high power rating charged from docking station plus suitable control circuitry which can in turn provide the super capacitors

within the device or devices with high current flow and therefore provide for rapid charging through a simple electrical mating operation.

According to a second aspect of the present invention there is provided an electrically powered portable device, the device including means for providing a function to be performed by the device, an electrical power supply which incorporates at least one capacitor for storing electrical charge to power the device, electronic control circuitry to control electrical power drawn from the electrical power supply for driving the function providing means, and a recharge interface for recharging the electrical power supply, the recharge interface being arranged to be electrically connectable to a charging device.

Preferred features are defined in the dependent claims.

In a preferred embodiment there is provided a portable delivery device for the release of volatile actives such as air fresheners and pest control products that utilise as a power source fast charge super-capacitors.

Super capacitors inherently have a number of attributes that make them suitable for providing power for such portable devices, such as: very rapid charge (< 15 seconds, ideally 2 – 15 seconds and more ideally 2 – 5 seconds); can be cycled thousands of times without detrimental effects or reduced life (no chemical reactions); light weight; high power density; extremely low internal impedance for high power, low loss charging and discharging; form factor, shape can be customised for relatively low sales volumes; compact energy source (e.g. for a delivery device typically half the size of an AA battery for 2 to 5 hours use); and/or environmentally friendly, allowing for improved alignment of the device manufacturers with proposed European recycling and transportation legislations specifically related to batteries and battery powered products.

To increase the energy that can be transferred to the device and stored in the device's super-capacitor, and increase the functional and economic suitability of super-capacitors for the purpose(s) described herein, the wand would be able to

charge the capacitor in the device to typically 3.6V which is greater than the rated working voltage of the super capacitors (typically 2.5V) specified by the manufacturer.

The size of the super capacitor will be dependant on the device needs and will ideally drive the device for the period of the expected need of the device.

Once charged the power source will ideally drive the delivery device for 2 – 25 hours prior to recharge, this will be dependent on the average power required to deliver the active - a function of the quantity of active that is required to be delivered, its associated volatility and the delivery method being used. This could take the form of a heater system, fan system or more ideally low power piezoelectric spray nozzle technology. To extend the period of time between charges further i.e. up to 5 days a control circuit having an on/off pulse mode could be included, the frequency and duration of the pulse being tailored to meet the specific needs of the product.

Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:-

Figure 1 is a schematic block diagram of a first charging system for a first portable electronic device, the system including a portable charging wand in accordance with a first embodiment of the present invention and a portable device in accordance with a second embodiment of the present invention, the portable device being chargeable by the portable charging wand; and

Figure 2 is a schematic block diagram of a second charging system for a second portable electronic device in the form of a delivery device, the system including a portable charging wand in accordance with a third embodiment of the present invention and a delivery device in accordance with a fourth embodiment of the present invention, the delivery device being chargeable by the portable charging wand or a base unit in accordance with a further embodiment of the present invention.

Referring to Figure 1, in a first preferred embodiment of the present invention the rapid charge system includes: a powered device; a control circuit; to control the function of the device e.g. for an delivery device to control the duration of spray pulses and/or time between sprays so as to increase or reduce the rate of fluid dispense and the period between charges; to regulate constant power from the super-capacitor as it discharges; a power source, using one or more super-capacitors capable of fast recharge; a re-charge indicator; an On/Off control, or alternatively the device may not have an On/Off switch or a recharge indicator.

In this embodiment the device starts when the capacitor has sufficient charge and stops spraying when there is insufficient charge to power the device or the active has expired.

There is a charge point to make electrical contact with a portable charging wand. The portable charging wand contains either batteries or another, preferably larger, super-capacitor that can be carried around to rapidly recharge multiple portable devices around the home. The recharging wand contains circuitry to rapidly charge devices suitable for house hold delivery. The device and recharging wand each have bodies to meet aesthetic and function requirements of the product. The device has a docking station for the recharge wand, which can trickle charge or fast charge depending on the needs of the charging wand.

Referring to Figure 2, in a second preferred embodiment of the present invention the delivery device consists of: a reservoir to contain the active to be emanated; a conduit to transfer the active from the reservoir to the delivery surface; powered delivery means, preferably piezoelectric spray nozzle technology (other embodiments may use a variety of other delivery mechanisms such as heaters, fans etc); a control circuit, to control the duration of spray pulses and/or time between sprays so as to increase or reduce the rate of fluid dispense and the period between charges (ideally the time between sprays is from 30 seconds to 30 minutes with a dispense volume of 0.01mg – 0.5mg per pulse), and to regulate constant power from the super-capacitor as it discharges; a power source, using one or more super-capacitors capable of fast recharge; a re-

charge indicator; an On/Off control, or alternatively the device may not have an On/Off switch or a recharge indicator, in which embodiment the device starts when the capacitor has sufficient charge and stops spraying when there is insufficient charge to power the device or the active has expired; a charge point to make electrical contact with a portable charging wand, wireless recharge station, or docking station at mains outlet; a portable charging wand containing either rechargeable batteries or another, preferably larger, super-capacitor that can be carried around to rapidly recharge multiple portable delivery devices around the home. (In other embodiments the portable charging wand could be replaced by a more permanent docking station, which could be mains or battery driven). The recharging wand or station contains circuitry to rapidly charge devices suitable for house hold delivery. The device has a body for the device to meet aesthetic and function requirements, and the recharge wand and/or docking station have a body to meet aesthetic and function requirements.

CLAIMS:

1. An electrically powered portable charging device suitable for temporarily storing electrical charge for delivery to an electrical device electrically connectable to the charging device, the charging device comprising at least one storage element for temporarily storing electrical charge, an input for receiving, from a separate charging base unit to which the charging device is electrically connectable, an electrical charge to be stored by at least one storage element, and an output for delivering the stored electrical charge to the electrical device.

2. A charging device according to claim 1 wherein the input comprises a first electrical connector for electrical connection to a charging base unit and the output comprises a second electrical connector for electrical connection to an electrical device to be charged.

3. A charging device according to claim 2 wherein at least one of the first and second electrical connectors comprises low impedance contacts, having an impedance of not more than 0.2 Ohms.

4. A charging device according to any one of claims 1 to 3 wherein the charging device has a total impedance of not more than 0.3 Ohms.

5. A charging device according to any foregoing claim wherein the at least one storage element comprises at least one capacitor which has a capacitance of 10 to 50 Farad.

6. A charging device according to claim 5 wherein at least one capacitor has a working output voltage of from 1V to 3.6V.

7. A charging device according to claim 5 or claim 6 wherein at least one capacitor is an electrochemical double layer capacitor or super capacitor.

8. A charging device according to any foregoing claim wherein the input is adapted to receive a trickle charge or rapid charge from a base unit.

9. A charging device according to any foregoing claim wherein at least one storage device comprises one or more battery dry cells or rechargeable batteries.

10. An electrically powered portable device, the device including means for providing a function to be performed by the device, an electrical power supply which incorporates at least one capacitor for storing electrical charge to power the device, electronic control circuitry to control electrical power drawn from the electrical power supply for driving the function providing means, and a recharge interface for recharging the electrical power supply, the recharge interface being arranged to be electrically connectable to a charging device.

11. An electrically powered portable device according to claim 10 wherein the recharge interface is arranged to be selectively electrically connectable to a portable charging device or a charging base unit adapted to be powered by mains electrical power.

12. An electrically powered portable device according to claim 10 or claim 11 wherein the at least one capacitor which has capacitance of from 10 to 50 Farad.

13. An electrically powered portable device according to any one of claims 10 to 12 wherein the at least one capacitor has a working output voltage of from 1V to 3.6V.

14. An electrically powered portable device according to any one of claims 10 to 13 wherein the at least one capacitor is an electrochemical double layer capacitor or super capacitor.

15. An electrically powered portable device according to any one of claims 10 to 14 wherein the recharge interface has a total impedance of not more than 0.3 Ohms.

16. The combination of the charging device of any one of claims 1 to 9 and the electrically powered portable device of any one of claims 10 to 15.

17. The combination of claim 16 wherein at least one storage element of the charging device comprises at least one capacitor which has a capacitance of from 10 to 50 Farad and the time to charge the at least one capacitor in the electrically powered portable device is from 2 to 15 seconds.

18. The combination of the charging device of any one of claims 1 to 9 and a charging base unit having an electrical output for connection to the input of the charging device, the charging base unit being adapted to be powered by mains electrical power.

19. The combination of claim 18 wherein at least one storage element of the charging device comprises at least one capacitor which has a capacitance of from 10 to 50 Farad and the time for the charging base unit to charge the at least one capacitor in the charging device is from 2 to 15 seconds.

20. An electrically powered portable device according to any one of claims 10 to 15 which is a delivery device for release of at least one volatile compound stored in the device.

21. A delivery device according to claim 20, the delivery device comprising a reservoir for storing the at least one volatile compound, a dispensing device for dispensing the at least one volatile compound from a delivery surface of the dispensing device, the electronic control circuitry controlling the dispensing device, a conduit to transfer the at least one volatile compound from the reservoir to the delivery surface, and the at least one capacitor of the electrical

power supply is capable of containing sufficient charge to power the dispensing device for a predetermined period.

22. A delivery device according to claim 21, wherein the period is from 2 to 25 hours.

23. A delivery device according to any one of claims 20 to 22 wherein the charging device to which the recharge interface is arranged to be electrically connectable to is a portable charging device according to any one of claims 1 to 9 or a charging base unit having an electrical output for connection to the recharge interface, the charging base unit being adapted to be powered by mains electrical power.

24. A delivery device according to any one of claims 20 to 23 wherein the dispensing device is adapted periodically to dispense the at least one volatile compound as a spray.

25. A delivery device according to claim 24 wherein the electronic control circuitry is adapted to control the duration of spray pulses and/or the time between successive sprays.

26. A delivery device according to any one of claims 20 to 25 wherein the dispensing device is adapted periodically to dispense the at least one volatile compound and at least one capacitor and electronic control circuitry are adapted to provide a periodic delivery of the at least one volatile compound for a period of up to 5 days in a given charging cycle of the at least one capacitor.

27. A delivery device according to any one of claims 24 to 26 wherein the time between successive pulses is from 30 seconds to 30 minutes, and the delivery weight of the at least one volatile compound per pulse is from 0.01mg-0.5mg.

28. A delivery device according to claim 27 wherein the delivery weight of the at least one volatile compound per pulse is from 0.03mg-0.3mg.

29. The combination of the charging device of any one of claims 1 to 9 and the delivery device of any one of claims 20 to 28, the output of the charging device being connectable to the recharge interface of the delivery device.

30. The combination of claim 29 wherein at least one storage element of the charging device comprises at least one capacitor which has a capacitance of from 10 to 50 Farad, at least one capacitor of the delivery device has a capacitance of from 10 to 50 Farad and the time for the charging device to charge the at least one capacitor in the delivery device is from 2 to 15 seconds.

31. The combination of the delivery device of any one of claims 20 to 28 and a charging base unit having an electrical output for connection to the recharge interface of the delivery device, the charging base unit being adapted to be powered by mains electrical power.

32. The combination of claim 31 wherein the at least one capacitor of the delivery device has a capacitance of from 10 to 50 Farad and the time for the charging base unit to charge the at least one capacitor in the delivery device is from 2 to 15 seconds.

Fig. 1

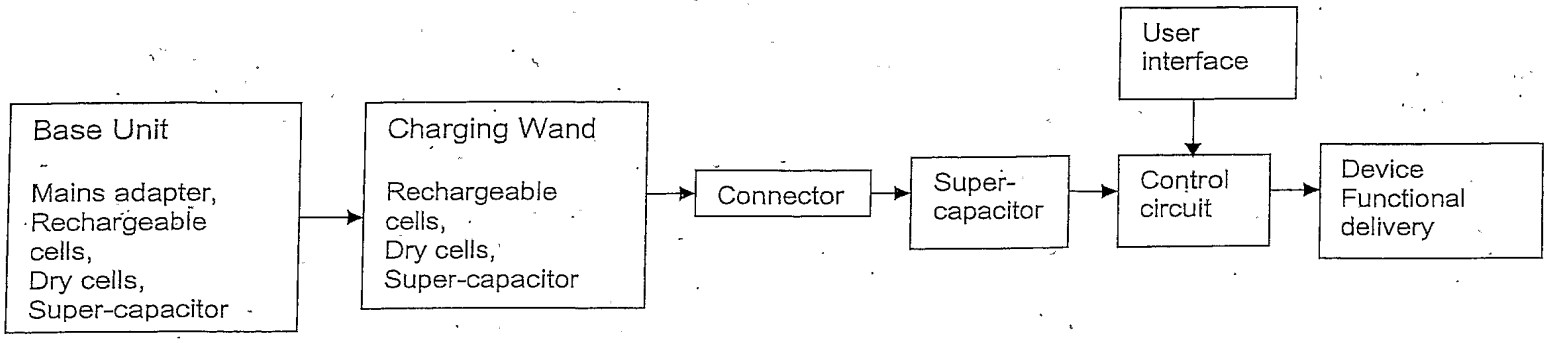
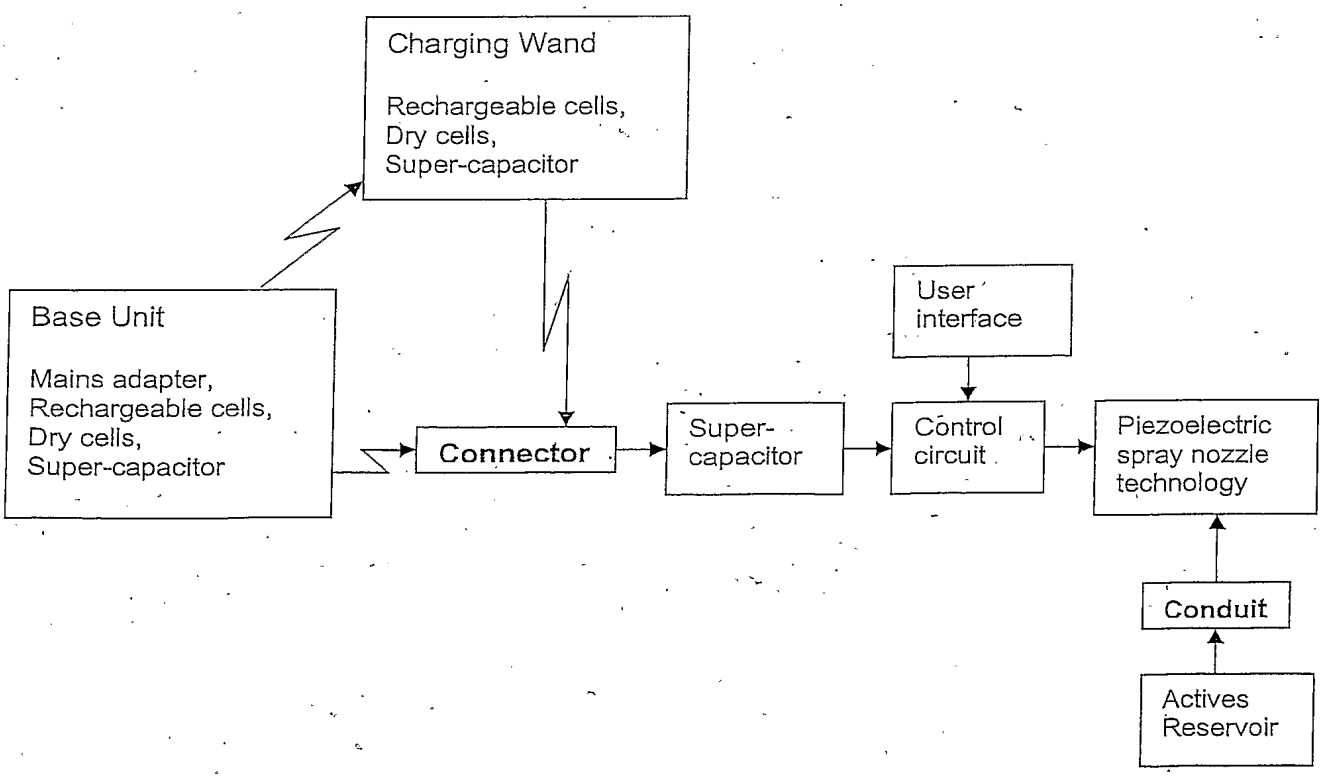

Base Unit
Mains adapter,
Rechargeable
cells,
Dry cells,
Super-capacitor
Charging Wand
Rechargeable
cells,
Dry cells,
Super-capacitor
Connector
Super-
capacitor
User
interface
Control
circuit
Device
Functional
delivery

Fig. 2


Charging Wand
Rechargeable cells,
Dry cells,
Super-capacitor
Base Unit
Mains adapter,
Rechargeable cells,
Dry cells,
Super-capacitor
Connector
Super-
capacitor
User
interface
Control
circuit
Piezoelectric
spray nozzle
technology
Conduit
Actives
Reservoir

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